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The CIWMB's Modesto Compost Emissions Study

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This Presentation

1. Why study emissions?
2. Protocol for the Modesto Study
3. Results of Modesto Study

Human Health Effects
Ozone reacts readily with membranes lining the lung's air passages as well as the eye. Mounting scientific evidence links ozone to a number of short- and long-term respiratory and visual problems:

•Decreased lung functioning, especially in children that are active outdoors.

•Shortness of breath, coughing, wheezing, chest tightness, headaches and nausea.

•Pronounced allergic reactions.

•Increased hospital admissions for respiratory problems

Plants and Crops
Ozone interferes with the ability of green plants to convert sunlight into useful energy.

Agricultural crops, commercial timber, lawns, gardens and natural ecosystems affected

The EPA estimates that ground-level ozone pollution is responsible for several hundred million dollars in annual losses from reduced crop yields.

But, how much VOCs are released from composting operations?

Emissions have to be measured because you can't just look at a compost operation and tell how much VOCs are being emitted? Possibly much of what people see coming off of compost piles is evaporating water, which is not really pollution (though it may add to greenhouse affect).

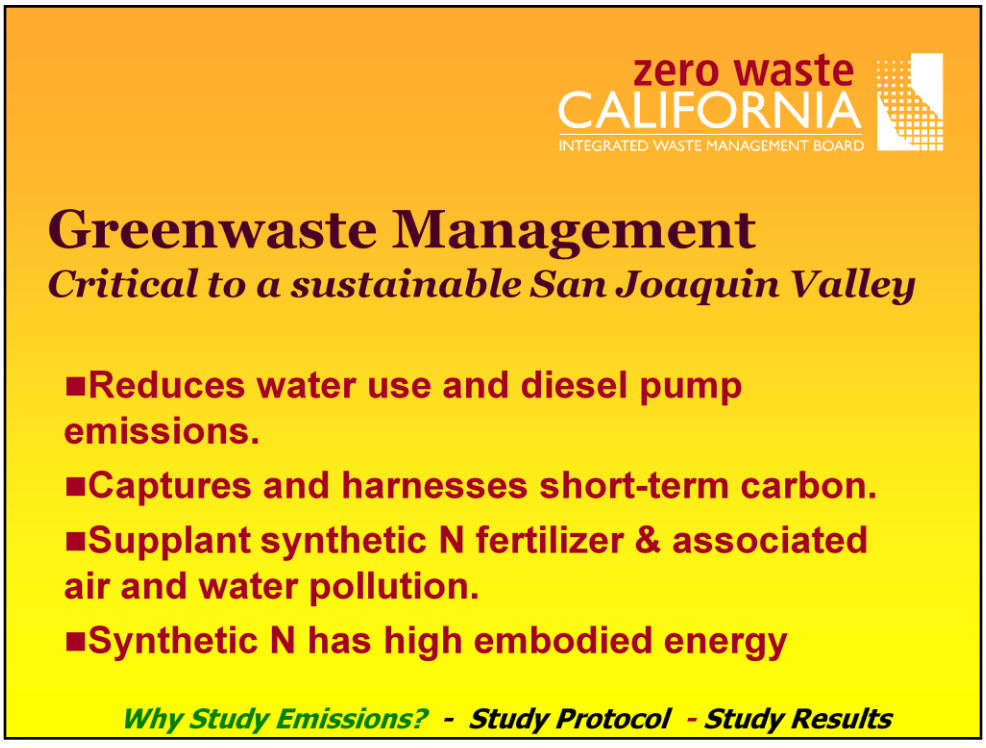
What about smell? If a compost facility produces a lot of odor, does that mean it pollutes more than a compost facility which does not smell? It seems logical, but there are differing views on this subject.

In the South Coast, new Co-compost facilities must reduce VOCs and ammonia by 80% compared to the baseline, and existing facilities must show a 70% reduction. All co compost facilities must be incompliance by 1/1/2009 Chippers and grinders have to get chipped and ground material off site in 3 days to prevent inadvertent composting, and they cannot let raw materials sit for more than a week. Their greenwaste compost rulemaking process is expected to begin later this year.

In the San Joaquin Valley, biosolids or manure composters with volumes greater than 100,000 tons per year must implement VOC capture and control with at least 80% efficiency. Smaller operators can choose from a menu of best management practices. A regulatory process for greenwaste composters is now underway. Air quality regulators expect rule 4566 to be adopted in early 2009.

The San Joaquin Valley Unified Air Pollution Control District will be the first district in the country to attempt to control emissions from responsible greenwaste management. This has potentially serious impacts on the composting industry in California.

Land is still relatively inexpensive in the Central Valley. Despite a growing population, there are many miles of sparsely populated land. Two of the largest compost operations in the state are located here, also, some of the few which are permitted to take food-waste are here, as well.



If the vision of agriculture in the San Joaquin Valley of the future is one of sustainability, then the Valley needs more compost, not less. And the compost needs to remain cost-competitive with synthetic fertilizers.

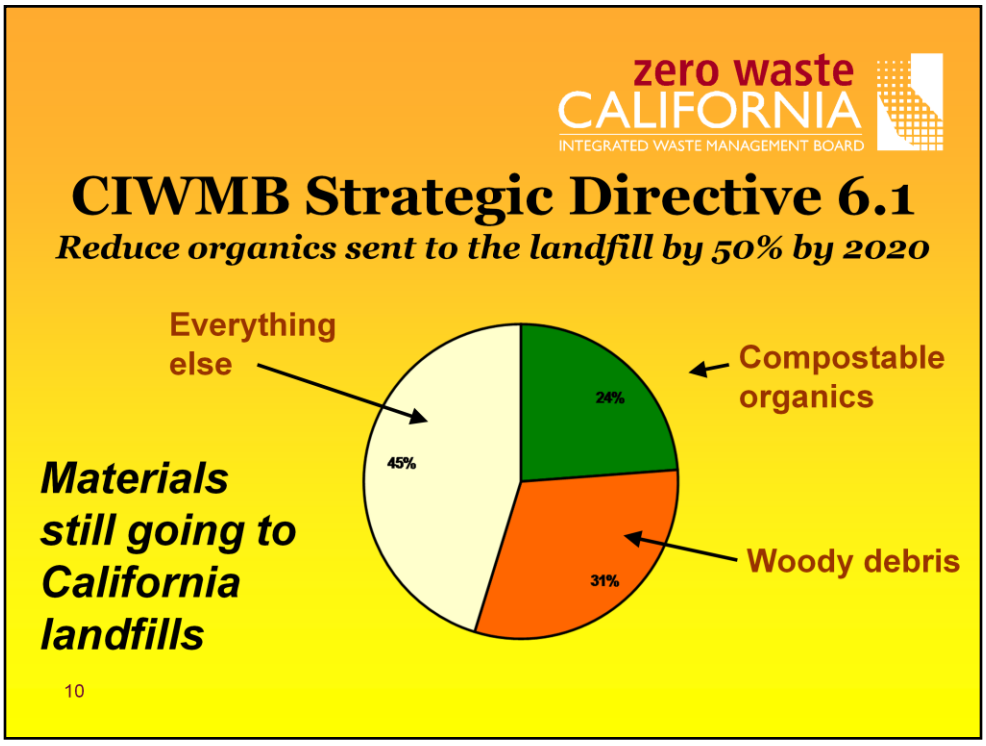
Composting sequesters carbon and keeps the short-term carbon cycle moving. It also grows bigger, stronger plants that can absorb even more carbon from the air.

As energy prices rise, compost should become more competitive, because it takes enormous amounts of energy to produce synthetic nitrogen fertilizers. Excessive regulations will reduce that potential future edge and inadvertently promote the continued overuse of synthetic fertilizers

In 1999 and 2000, CARB paid for fairly extensive research on emissions from fertilizer applications around the San Joaquin Valley. Based on that research, an average of 2.5 percent of all N applied winds up in the air, but that can go as high as 6 % with some surface applications. Most of it winds up as ammonia, but it's possible that some of it could wind up being converted to NOx, which is a criteria pollutant. Some of it could wind up being converted to N2O, a potent greenhouse gas.

The total energy input into the production of a kilogram of average U.S. wheat grain is estimated to range from 3.1 to 4.9 MJ/kg, with a best estimate at 3.9 MJ/kg. The dominant contribution is energy embodied in nitrogen fertilizer at 47% of the total energy input, followed by diesel fuel (25%), and smaller contributions such as energy embodied in seed grain, gasoline, electricity, and phosphorus fertilizer.


Increasing compost use…
…may decrease use of less sustainable methods.



In February, 2007, The CIWMB Board adopted 12 strategic directives, which serve as a tool that will allow the CIWMB to continue reduce the amount of resources being wasted and move beyond the 50% diversion goal which has been met.

According to the CIWMB's Organics Summit Background discussion paper issued in October, 2007, 10 million tons of compostable organics and 13 million tons of woody debris are landfilled annually. In order to accomplish the Board's directive, some 50 to 100 new facilities, each capable of processing around 100,000 tons per year — combined with a commensurate expansion in existing facilities, and an increase in source reduction via grasscycling and sustainable landscaping — are needed.

So, the Board is calling for more composting facilities at a time when air and water quality regulators are placing new regulations on composters which could force some of them out of business.

The life cycle in this case is about two months. Testing began the day after the windrows were created. There were basically 10 test days over a 57-day period.

The two emissions-reducing best management practices are:

1) a cap of approximately 6 inches of finished compost poured over the top of the active compost windrow. The cap was replenished after the first turn.

2. Two commercial applications. One is food for microbes which is ground into the windrow when it is made. The other is a topical spray which forms a crust on the surface that seals in some of the

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4 Windrows Studied

1. Pure greenwaste (57 days)
2. Greenwaste mixed with 15% food waste from local canneries (57 days)
3. Greenwaste with two commercial additives (14 days)
4. Greenwaste with 'biofilter' cap of 4-6" of finished compost (14 days)

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Putting on the "pseudo-biofilter" compost cap

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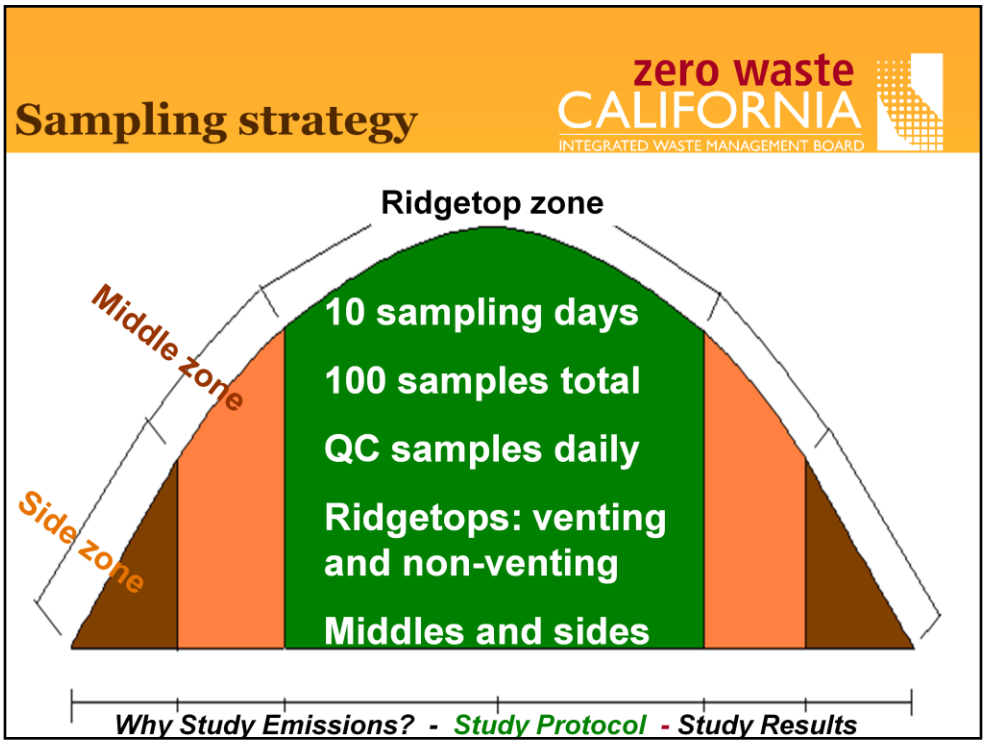
Emissions-Reducing BMPs

- Additive 1: feeds microbes; applied when pile created only
- Additive 2: forms crust on windrow; re-applied after turning
- Cost of additives: $1.50 per ton
- Biofilter: re-applied after turning using unscreened compost
- Cost of biofilter: 60 cents per ton

We hired Dr. Chuck E. Schmidt to do the sampling. He is one of the experts on the flux chamber, and helped invent this device. All samples were shipped to a lab in LA to be analyzed according to protocol 25.3 developed by the South Coast Air Quality Management District. This protocol involves measuring the gaseous and the liquid portions of the samples. You can see the coolers here used to hold the dry ice which keeps that fraction in the liquid stage so it can be measured. The large gas canisters are the sweep gas which is used to purge the flux chamber before and after every sampling event.



This is far more samples than have ever been done in one study before, actually, its probably more than all previous studies combined. Previous studies of one greenwaste composter in Southern California, upon which folks are proposing to build regulations, had far fewer samples, took those samples for shorter durations, and integrated many samples into one canister. All samples taken in Modesto were kept separate and rushed to Southern California for laboratory analysis.

This was done at the request of the San Joaquin Valley Unified Air Pollution Control District. As expected, we do find that emissions increase after turning.

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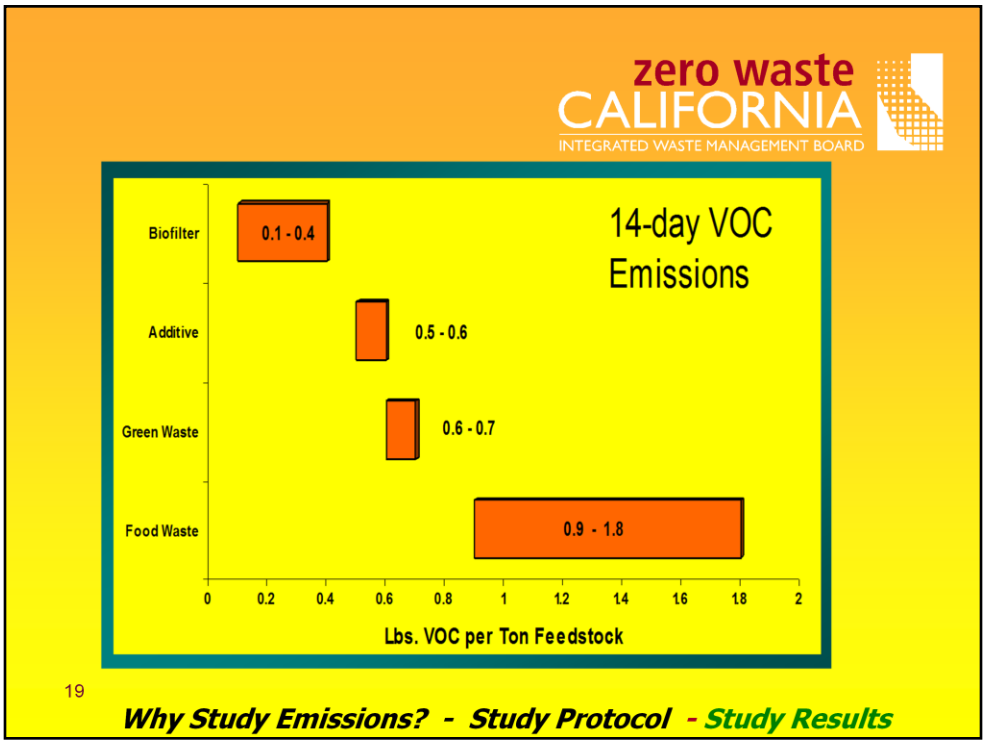
Conclusions

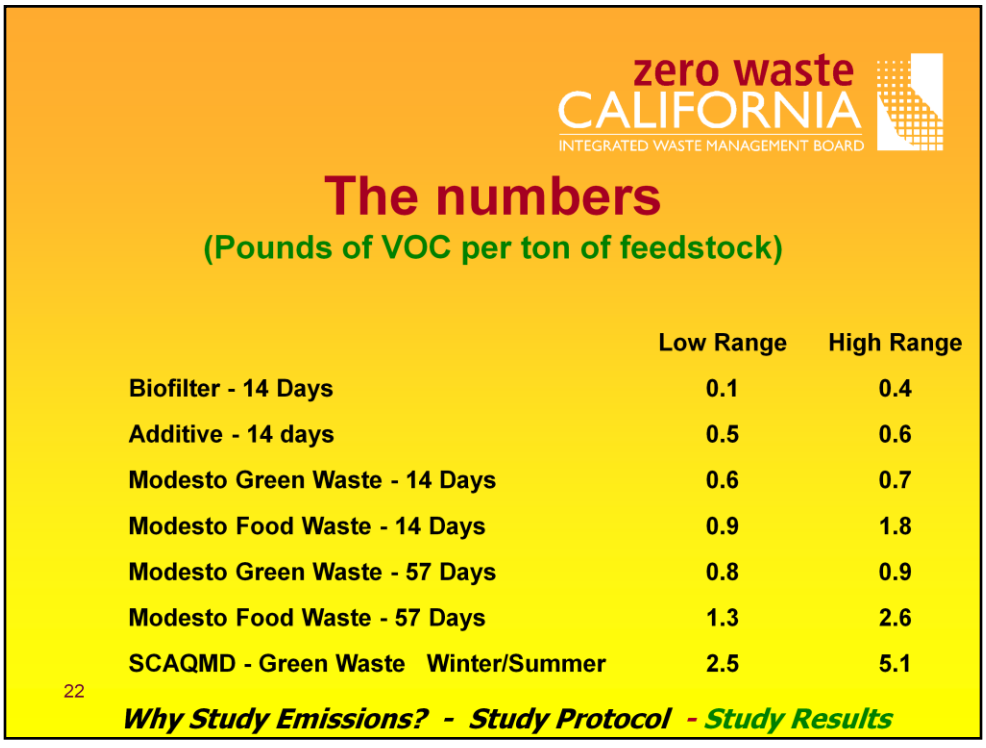
- 70-80% of VOCs emitted during first 2 weeks.
- 70-85% of VOC emissions vent through ridgetop.
- "Pseudo-biofilter" compost cap reduced VOC emissions 75% for first two weeks.
- Additives reduced VOC emissions 42% for first week but only 14% for first two weeks.
- 15% food waste roughly doubled VOC emissions compared to greenwaste.



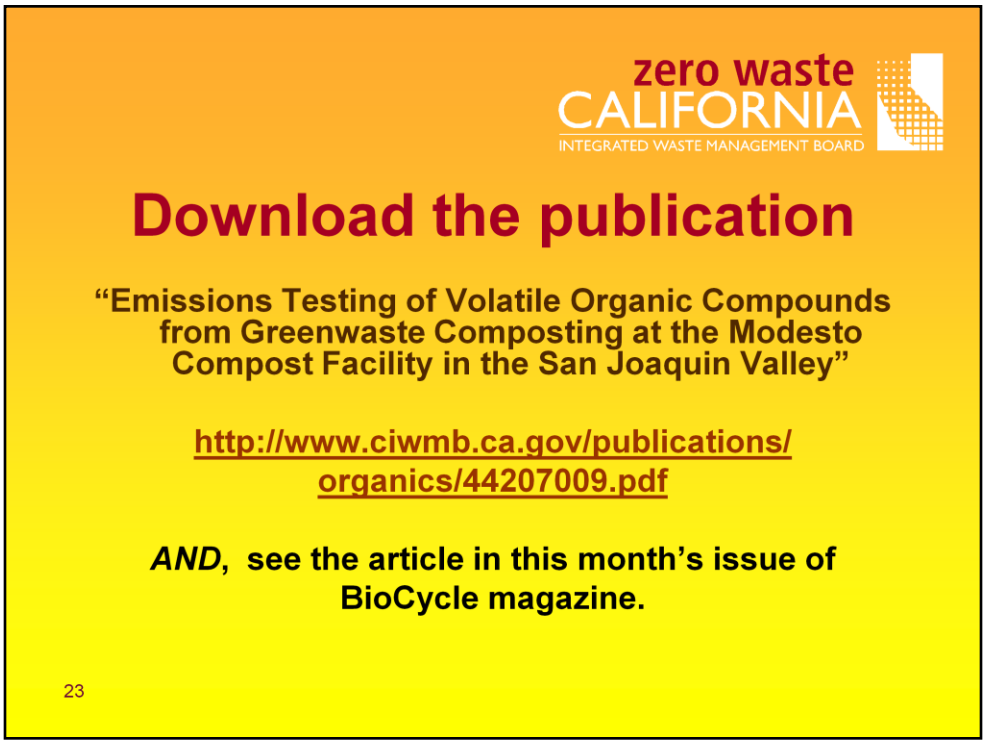
This shows the emissions over the initial two weeks period for all four windrows. Note the improvement in the bio-filter windrow over the straight greenwaste. Note that these results are expressed as a range. The range is based on different ways of calculating the venting versus non-venting surfaces of the windrow.

Here you see food waste and green waste emissions for the 14-day and the full 57-day cycles. The green up here and the food down here. This type of pattern is consistent with previous work which indicated most emissions come in the first two weeks. Up hereon the right you see the very early studies by the South Coast AQMD, the winter study was the low end of the spectrum and the higher end of the spectrum was achieved in hot weather. The total amount of samples taken on a green waste windrow was actually one canister of gas obtained in 8 sampling locations.

One of the main points I'd like to leave you with is that the pseudo-biofilter compost cap appears to be an effective VOC mitigation strategy. Using the lower end of the measured emissions range, the compost cap reduced VOCs by around 83%. Using the high-range emissions, the reduction was still more than 42%. So either way, it looks like the compost cap could be an important part of any plans to reduce VOC emissions.



Who here likes big tables of numbers? I want to reiterate right here that the SCAQMD numbers are each basically one day of sampling for one facility. In my opinion, this facility was atypical. The sampling most mostly conducted on huge tipping piles and huge piles of shredded materials; there was very little sampling on windrows. Even though the tipping and static piles were sampled once in the summer and once in the winter, the greenwaste pile was sampled only once. Based on the numbers in that study, windrows only made up 19% of this facility's total surface area, compared to 55% for tipping piles and 38% static piles of processed waste. What I noticed in my visits to most of the composting facilities in the San Joaquin Valley is that they are all upward of 90% windrows, many of them near 100%. The tipping piles are very small. Some of the smaller facilities get everything into the windrow THAT Day. So, I went back and reculated these numbers using the original SCAQMD measurements, but with a more fair facility composition of 90% windrow, 10% static and 10% tipping. That 5.1 number became 2.45.



You can go to Google and enter the following: CIWMB VOC Emissions Modesto and it will come up #1.

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Any questions?

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